



## ATCR-44 S - SOLID STATE L-BAND AIR TRAFFIC CONTROL SURVEILLANCE RADAR (EXTENDED TMS, EN-ROUTE)

### GENERAL FEATURES

**The ATCR-44S is the L-band Air Traffic Control Radar, particularly suited for extended TMA and en-route applications.**

It is a fully coherent high-end class Primary Surveillance Radar, which uses a fully solid state, fail-soft transmitter. The ATCR-44S represents an outcome of the SELEX Sistemi Integrati experience in the field of advanced radar systems and takes advantage of the acquired know-how and of the latest developments in the state-of-the-art technology.

The ATCR-44S is designed to comply with the main international standards for PSR sensors and in particular with the requirements issued by ICAO and EUROCONTROL, both for functional and performance characteristics.

The equipment is designed according to the criteria of operational redundancy of all critical units. The transmitter, which uses all solid state components, is a single unit composed of parallel operating modules.

The transmitter redundancy is obtained through the fail-soft capability, which guarantees the continuity of operation in case of partial failures.

All design, materials, manufacturing techniques and workmanship are in accordance with the highest recognised international standards.

The equipment meets the European EEC directive in terms of EMI/EMC and safety standards.

The ATCR-44S is designed with replaceable plug-in modules and printed circuit boards to the greatest possible extent.

Equipment access is studied to reduce repair time. The units are designed and developed to permit ready access from the front to all modules, printed circuit boards, assemblies, test points, terminals and wiring for maintenance activity.

Corrective maintenance only consists of removal and replacement (plug-out, plug-in) of complete assemblies/LRU with a few and simple adjustments.

Full control of radar parameters allows a simple and effective radar optimisation at the site in order to face a wide variety of operational conditions.

A wide range of processing techniques are automatically employed in the ATCR-44S to ensure maximum operational performance under any environmental condition.

The selection of the most appropriate available techniques is controlled by an extensive geographical mapping system managed by the extractor/controller computer which is integrated into the radar.

An integrated weather receiver is included in the ATCR-44S to provide six level weather contours, in terms of six standard reflectivity levels, as defined by the U.S. National Weather Service.

The ATCR-44S can operate in conjunction with two antennas of SELEX Sistemi Integrati:

- The high gain dual beam G-14 reflector antenna, providing two beams (main and auxiliary)
- The ALE 3x5 planar array antenna, providing a multi-beam capability for improved radar performances

Typically, the ATCR-44S configuration is composed of:

- Modular solid state transmitter with fail-soft capability
- Redundant receivers for target and weather signal detection
- Duplicated digital A-MTD Signal Processors for target and weather signal processing
- Duplicated digital Extractor/Controller
- Monitoring and Control Position



The ATCR-44S is also available in a configuration well suited for mixed civilian (ATC) and military applications, equipped with additional devices providing ECCM capabilities in terms of frequency agility over 16 frequencies with automatic selection of the least jammed frequencies (AFS).

## HIGHLIGHTS

- Designed for unattended 24/24 hours operation, using redundant subsystems with a built-in test equipment (BITE) to permit fast and accurate fault diagnosis and monitoring, together with high capability of identification and isolation of failures down to LRU level.
- High reliability with a critical MTBF higher than 40.000 hours
- MTTR of 0,4 hours
- Availability of 99,999%
- Fully solid state and fail-soft modular transmitter for reduced maintenance and repair costs
- Non-linear frequency modulated (NLFM) transmitted waveform to improve the pulse compression performance and further reduce interference signals
- Operative frequency selection can be done at site among 16 available carriers, choosing the most suited for band utilization needs or reduction of interferences and disturbs
- Sector blanking: up to 8 azimuth sectors can be selected where no RF radiation can be performed
- Adaptive antenna beam switching (between main and auxiliary) for improved ground clutter suppression
- Linear/circular switchable polarisation
- High performance receiver employing double frequency conversion
- Adaptive STC for enhanced target detectability in clutter
- Digital pulse compression with enhanced peak-to-sidelobe ratio for high radar sensitivity
- Fully coherent adaptive moving target detection (A-MTD) system with four sets of doppler filters including 6, 7, 8, 9 or 10 filters for each set
- Adaptive selection among the four MTD filter sets on the basis of a range/azimuth map according to ground clutter intensity
- Extensive mapping techniques employed to maintain CFAR in presence of high density, non homogeneous clutter
- False Alarm Normaliser (FAN) map for each MTD filter
- High resolution Fine Doppler Map (FDM), independent for each MTD filter, providing super-clutter visibility and assuring tangential target detection, ducted (anomalous propagation) and angel clutter suppression
- Asynchronous Interference Blanking (AIB) function
- Censoring Level Map (CLM): used to reduce possible false alarms generated in areas where vehicular traffic or very strong fixed echoes are present
- Built-in plot extractor based on the "weighted mean logic" to give best plot accuracy and quality

- Extensive Built-In Test (BIT) function for automatic on-line failure detection of all radar components, from the antenna to the extractor
- Extensive auto-diagnosis circuits (BITE) in all units guaranteeing a high capability of identification and isolation of failures down to LRU level
- Full monitoring and control capability from local or remote positions with user-friendly, look and feel HMI

## TECHNICAL FEATURES

### System capabilities

- Frequency band:	from 1250 MHz to 1350 MHz
- Maximum range:	up to 220 NM (according to operational requirement)
- Target accuracy:	120 m / 0.2°
- Target resolution:	750 m / 3.2°
- Antenna gain:	36 dB (nominal)
- Antenna azimuth beamwidth:	1.2°
- Antenna rotation rate:	5, 6 or 7.5 rpm (typically)

### Transmitter:

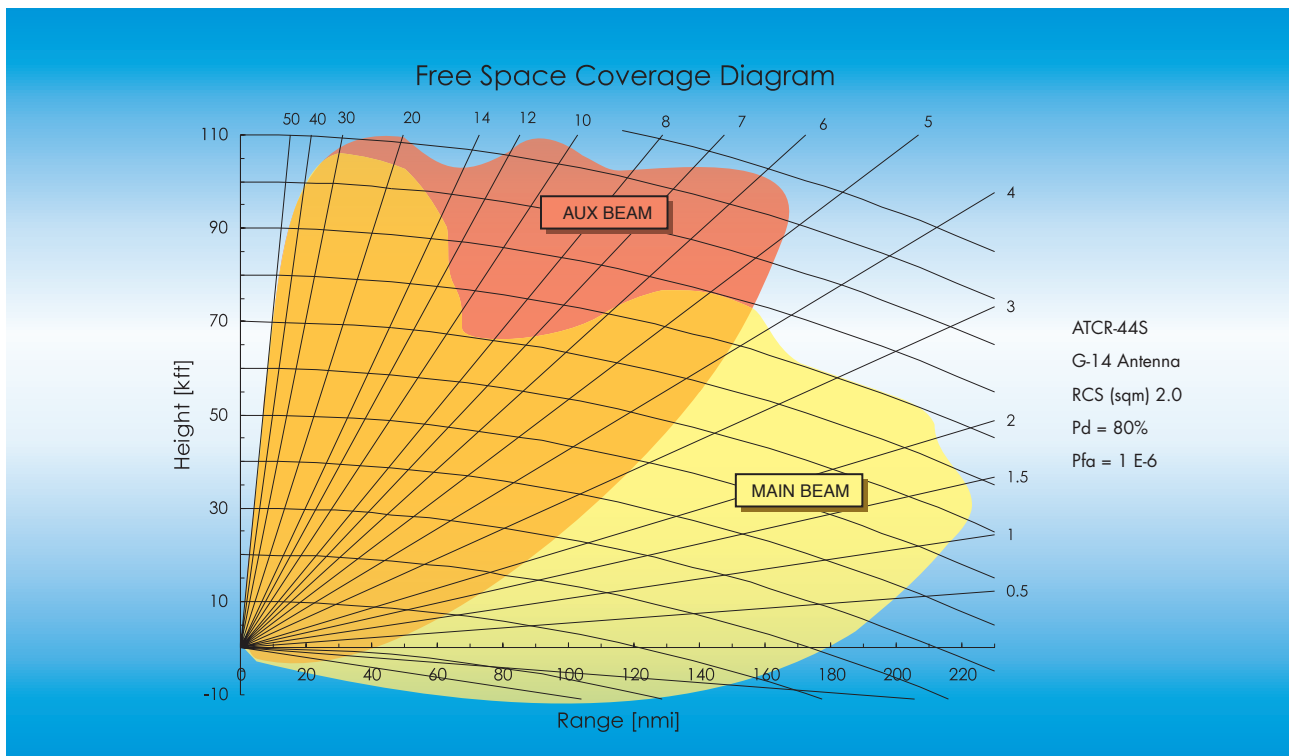
Architecture:	Modular with fail soft capability
Peak power:	24 kW (16 modules)

### Transmitted Waveforms:

32 $\mu$ s coded short pulse for short range coverage	
150 $\mu$ s coded long pulse for long range coverage	
Both pulses compressed at 2.8 $\mu$ s	
Other pulse widths available according to operational requirements	
PRF:	400 Hz (typical)
Staggering:	batch to batch
Cooling:	air cooling

### Receiver:

Dynamic range at RF:	90 dB
Dynamic range at IF:	61 dB
Noise figure:	1.5 dB
IF frequency:	1-st IF frequency: 553 MHz
	2-nd IF frequency: 30 MHz
Phase detectors:	Two phase detectors for In-phase (I) and Quadrature (Q) components





## SYSTEM CONTEXT

The ATR-44S sensor is used in a modular architecture to build a complete radar head system comprising fully redundant data processing units (Radar Head Processors), local maintenance displays, Control and Monitoring System (CMS), data recording and analysis tools.

The SELEX Sistemi Integrati approach is to have a unified Data Processing subsystem able to generate radar tracks (from PSR and/or MSSR plots) and to correlate them in order to improve the detection and filtering capabilities of radar sensors, providing the ATC facilities with real-time, reliable and high confidence level information.

The maintenance strategy is based on a powerful built-in test equipment (BITE) and automatically and manually initiated software controlled tests in order to allow a fast and accurate fault diagnosis and isolation, to permit a prompt equipment operation restoring.

On-line internal test procedures continuously check the equipment performance. The CMS facility advises operators in case of failure and permits to configure the equipment unit in the most suitable operative status and allows later corrective maintenance action (fail-soft, fail-safe, memory correction, etc.)

Only a minimum of system maintenance actions need separate (external) standard test equipment.

SELEX Sistemi Integrati's training and documentation department has a relevant experience in education and keeps on training operational and technical personnel all over the world, improving the methods upon new guidelines and trainees feedback.

### Digital Signal Processor:

Type:	Adaptive Moving Target Detector (A-MTD) with four sets of 6, 7, 8, 9, 10 FIR filters
Detection Logic:	Fixed thresholding, CA-CFAR, adaptive thresholds (FDM), censoring thresholds
Maps:	Clutter, Beam Combiner, STC, MTD set selection (WSM), rain, False Alarm Normaliser (FANs)

### Extractor/Controller:

Plot extraction:	Weighted mean logic using filter amplitude for range/azimuth coordinate extraction, plot quality classification
Functions:	
	Radar timing control
	Operator interface
	System supervision